

FRENCH (W.B.)

THE MALARIAL
ORGANISM,

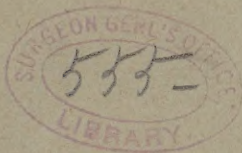
WITH REPORT OF CASES.

BY

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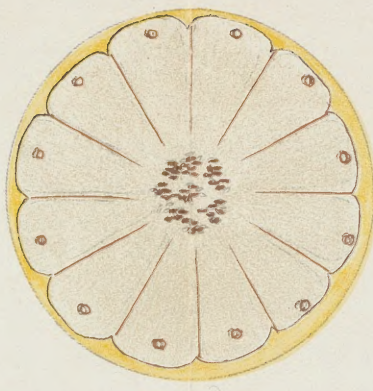
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THE MALARIAL ORGANISM,

WITH REPORT OF CASES.*

BY WILLIAM B. FRENCH, M. D.,

WASHINGTON, D. C.

IN asking your attention to a subject so familiar as malarial infection, it seems proper to state at the beginning of this paper my reasons for so doing.

In the first place, and most important, is the indisputable fact that we now have, thanks to Laveran, the means of making a positive and early diagnosis in nearly every instance. In the second place, that means is not ordinarily resorted to, with the result that in some instances, perhaps many, our patients are allowed to suffer unnecessarily. There is little excuse for most of us who neglect an opportunity to discover the truth when that opportunity is open to any one who has good eyes, a good microscope, and a little patience. Somebody has offered the suggestion that "it takes too much time to bother with a microscope, and, besides, anybody knows that if a man has a chill, fever, and sweat on alternate days he has malaria." The last statement is probably true enough, but the first is not. We know it is not unusual to consume two or three days, and I have seen good men occasionally spend twice that number, in making an uncertain diagnosis of malarial infection in patients who did not present typical symptoms. Now, how much more satisfactory it is to spend an hour, generally much less, to determine definitely

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what we have to deal with, or to exclude the disease in question, as the case may be. If the first examination of the blood is negative, a second should be made a few hours or a day later; even then this procedure is infinitely more conclusive than guessing, into which we are often enough forced, without adopting it uniformly because it is easier for us.

A word or two about those interesting-looking diagrams intended to represent some of the various forms in which the malarial organism appears when examined in fresh blood.

First, the tertian infection (diagrams Nos. 1, 2, and 3), most prevalent in the spring, summer, and early fall months, is found in its youngest visible form, the object shown in diagram No. 1—a red corpuscle having within itself a rather indefinite mass of protoplasm with active amœboid movements; sometimes looking as shown in the diagram, again changing to a star, cross, leaf, or other curious shape. A little later in its growth, fine granular, very actively moving pigment is seen; and still later it has grown to occupy half of the cell (diagram No. 2), the pigment granules are larger and more active, and the whole object is now much more distinct. The same organism is shown in its full development within a swollen red cell in diagram No. 3, which it has partly decolorized, and represents an average specimen. Some have more pigment, some less. This stage is reached about forty-eight hours after the first, and then the organism does one of several things: it may segment—that is, assume the form in diagram No. 4—and each of its twelve to twenty parts separate and infect new corpuscles, thus perpetuating the disease; or it may entirely decolorize the red cell and become an extracellular body, to be ingulfed by a leucocyte, or to break up into several smaller extracellular bodies by a process of budding, and disappear, leaving its pigment free in the plasma where the leucocytes absorb and show it, furnishing a point of diagnostic value when other forms are scarce. Forms 1, 2, and 3 are frequent in the circulating blood, the segmenting forms infrequent.

Still another change from its extracellular form is that to a flagellate body (diagram No. 5). The pigment be-

comes unusually active, arranges itself into a ring near the circumference, the rim of the body assumes at places a wavy, undulating motion, and suddenly there bursts from different points two to five or six flagella in the most frantic motion, thrashing about among the neighboring red cells and knocking them in all directions. Finally, at the end of half an hour or less, the flagella quiet down and remain motionless, or our friends the phagocytes may devour the body, flagella and all, in active motion; or a flagellum may detach itself and wander off alone, still retaining its activity, to be finally lost. The significance of the flagellate body is not a settled point as yet. These are the principal forms seen in tertian infection, though, as stated, the last two are quite scarce in the capillary circulation and give us the familiar chill, fever, and sweat on alternate days if it is a single infection; daily, if the infection is with groups of organisms which mature twenty-four hours apart.

Another distinctive type of malarial poisoning—the *æstivo autumnal*, the symptoms of which are known to most of us as “dumb chills”—is occasioned by the presence in the red cells of the organism shown in its youngest stage in diagram No. 6, which may closely resemble at this time the young tertian form, but a little later a careful examination of it will show some points of difference. It is smaller than the tertian, frequently assumes the ring-like form seen in diagram No. 6, and then changes rather abruptly to an irregular mass like diagram No. 1. This form in a variable time develops pigment granules, just as occurred in the young tertian, except that they are fewer in number, sometimes only two or three, and are not usually so active. It occupies only about a fourth of the corpuscle, never growing as large as the tertian. Segmentation occurs in this type of infection, though the segmenting forms are rarely if ever found in the capillary blood. Flagellate bodies are found as in tertian fever. The greater part of the development of this organism—*æstivo-autumnal*—probably occurs in the internal organs. The exact time required to reach its maturity is yet in doubt; probably it is anywhere from twenty-four to forty-eight hours, more or less, consequently the irregularity of the fever and other manifestations of its presence.

After this infection has lasted six to eight days there appear in the blood several forms totally unlike any found in the tertian—forms known as ovoids, round bodies, and crescents—two of which are shown in diagrams Nos. 7 and 8. These are usually extracellular, pigmented organisms, larger than a red cell, and probably a further development of certain of the organisms of this infection, which, instead of segmenting, assume the forms shown. Their presence indicates that the infection is a week old at least, and probably much more, and that it is the *æstivo-autumnal* form. Sometimes the crescents, as well as the ovoids and round bodies, have the remains of a red cell attached, shown here only in the crescent. The last-named form is very persistent, and remains in the blood frequently after other forms, and most if not all symptoms, have disappeared.

There is one other type to be referred to, and then, after reporting a case or two, I will not tax your patience further.

I refer to the quartan; but as I have had no personal experience with it, and in some six hundred malarial cases which were examined at the Johns Hopkins Hospital only five of this type were found, and in some three hundred and fifty or more examinations made at the Emergency Hospital in this city it has not been met with at all, a very brief reference will be made to it. In its earliest stage of development it resembles closely the tertian organism, being a small, hyaline amœboid body occupying but a small part of the red cell, having a sharper outline, a slower amœboid movement, with less range of motion. It develops pigment as did the other forms, but the granules are coarser, darker, and have very little motion. The red cell which it inhabits becomes shrunken and darker than normal, and sometimes has a greenish tinge. Their full development is reached at the end of about seventy-two hours, having gradually changed from something like the young tertian to the form resembling to some extent the full-grown tertian, retaining, however, the differences in quantity, color, and movement of their pigment. At this point they may segment, may become extracellular bodies, and break up by fragmentation or budding, or they may become

flagellate bodies. These various forms are smaller than the tertian, and may be studied in the circulating blood, where they seem to undergo their development. The diagrams before you, with such verbal changes as have been made, will, it is hoped, serve to illustrate the differences mentioned.

There are two or three cases to be reported, which emphasize the necessity of a resort to the microscope and the benefits which follow.

On October 17th last there was brought to the children's clinic, Emergency Hospital, service of Dr. Hawkes, a nursing white male child, four months and a half old. The child's mother—who, by the way, was only seventeen years and a half old—stated that her baby had been cross and fretful day and night for the last ten days; had lost weight; that it would not nurse, and seemed to be in pain. It had been in good health prior to the ten days mentioned, except an attack or two of summer trouble of which it was now well. For three days past it had lain quiet and apparently fast asleep, and could not be made to stay awake long enough to nurse. It had had cold hands and feet, and may have looked blue at times, but as the mother was of a class and age in life that does not observe very closely, the history was quite indefinite. The child now seemed to be comatose. Ordinary attempts to arouse it failed. Upon lifting the eyelids to examine its pupils, which were normal, it made no objection, nor did it when the corneæ were first touched; but after repeating the touching of the corneæ, shaking, and speaking loudly, it was finally aroused to a half-conscious, stupid state, which did not greatly help us in our diagnosis. Upon further questioning of the mother it was discovered that two weeks before this time she herself had had two or three shaking chills, but had recovered promptly. That statement led to an examination of the blood of the baby, in which were found numerous large tertian organisms represented in diagram No. 3. Had the case been that of an adult, the ordinary shaking chills, followed by fever and sweat on alternate days, would most likely have occurred, but the symptoms were modified, as they usually are, by the youth of the patient, and as symptoms generally are modified for the purpose of confusing the doctor.

Eight days later the baby was again presented, this time better in every way. Had laughed and played some during the intervals between visits, and was otherwise improved.

Examination of the blood showed a very few large tertian forms, but in addition a number of ringlike and intracellular hyaline bodies (diagram No. 6), indicating an infection with the æstivo-autumnal forms in the presence of tertian organisms—in other words, a double infection. Quinine was continued, and three days later the baby again appeared, with the tertian forms absent and only a few of the æstivo-autumnal forms left, and practically well on the road to recovery.

This case is interesting because of the extreme youth of the patient—four months and a half—because of the double infection which occurs in about two per cent. of cases only, and because of the satisfactory diagnosis and conclusion of the case. It seems very certain that a correct and immediate diagnosis would not have been made without an examination of the blood, nor would we, later in the sickness, have discovered the second infection before it had made serious mischief. The urgency of a prompt and certain diagnosis was very apparent—much more apparent than the little one's trouble—and we would have been morally responsible had we not made a correct diagnosis.

Most of us appreciate the sometimes embarrassing question of anxious parents, "What is the matter with baby?" and how our ingenuity and conscience are taxed by the reply we give. When we have a source of information that will so surely help us in the disease in question, why not turn to it?

There have occurred this summer and fall a number of cases of malarial infection in young children, under two years old, in the service of Dr. Hawkes, in which the symptoms were not so threatening as in the case cited but in which a correct diagnosis might have been easily overlooked without an examination of the blood, and which, if they had been treated for a number of other troubles whose symptoms resemble those of malaria, would have been quite as serious finally.

Through the courtesy of Dr. G. Byrd Harrison I am permitted to report from his service another case where the conditions were alarming.

In this instance a white man, aged twenty-one years, was brought to the hospital by the ambulance, August 14, 1895, at 2 P. M., in a comatose state. He was found where he fell on

the street, unconscious; skin hot and dry; temperature, 105.4° ; pulse, 110; and respiration, 24. Pupils were equal and reacted. No odor of alcohol or other drug. As the day was a hot one the diagnosis of heat stroke seemed very plausible, but at the suggestion of Dr. Smith, the resident physician, the blood was examined within two minutes, and showed an immense quantity of large tertian forms. The diagnosis of malarial coma was made, and a hypodermic injection of hydrochloride of quinine, fifteen grains, was given, together with thirty grains by the mouth. In two hours the temperature was 101.2° , and at midnight normal. The patient remained in the ward three days with no rise of temperature and was then discharged.

I believe this case to be the first reported instance of malarial coma from tertian infection. Additional cases could be cited where a positive and immediate conclusion was needed, but these two serve very well to emphasize the necessity of a blood examination when there is the least suspicion of malaria. When the organism is found we know at least one trouble with which we have to deal; there may be others, but it is probable there are not.

As to the best time to examine the blood: any time will generally result in finding the organism. There are times, however, when it is more plentiful in the general circulation than others, usually about the time of the paroxysm, but there is no occasion for delaying the examination; examine at once when the patient presents himself. If quinine in sufficient quantity to affect the system has been taken, then the search, unless for crescents and ovoids, will usually have to be longer, for the organisms will have been decreased in number, though a thorough search will generally discover them.

A one-twelfth-oil immersion lens is almost a necessity. The blood for the examination is collected from a very small drop, preferably from the lobe of the ear, as it is not very sensitive, by touching the top of the drop with a perfectly clean cover glass and laying it quickly upon a clean glass slide where it will spread in a thin layer. The glass must be clean, and only a small drop used—not larger than a pinhead—otherwise the layer of blood is apt to be too thick to examine satisfactorily. The margins of the cover

slip may be sealed with vaseline or melted paraffin if it is desired to preserve the slides for several hours, as is often the case, and if carefully prepared will keep well for from four to six or eight hours, and sometimes much longer.

Examination of the fresh specimen seems more satisfactory and simpler than staining, and is all that is required for diagnosis.

Explanation of the plate, showing some of the characteristic forms found in fresh blood in malarial infection.

Fig. 1. An early form of the tertian parasite.

Fig. 2. Half-grown tertian organism.

Fig. 3. Full-grown tertian organism.

Fig. 4. Segmenting form, common to the tertian, quartan, and æstivo-autumnal types of malarial infection.

Fig. 5. Flagellate body, also found in the three types mentioned.

Fig. 6. An early form of the æstivo-autumnal parasite.

Fig. 7. An ovoid body, found only in the æstivo-autumnal fever of a week's duration or more.

Fig. 8. A crescentic body, generally seen in the fresh blood without the so-called "bib" or remains of a red cell attached, and only found in the æstivo-autumnal fever.

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EDITED BY

FRANK P. FOSTER, M. D.

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